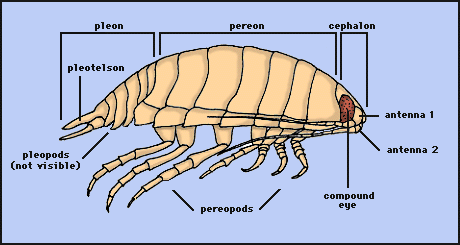
Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

**Animal Behavior Lab**

AP Biology 2015-2016

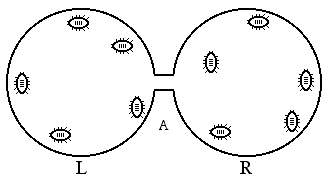


**Background Information:**

Pillbugs—also known as sowbugs, woodlice, or rolly pollies—can be found right in your backyard. They are mostly found in the northern central United States, though there are some species that live as far south as Florida. They have rounded backs and seven pairs of legs. Some species can roll up into a ball when they sense danger in the environment. Pill bugs play an important role in the environment by helping to decompose dead organisms and recycle nutrients into the soil.

Because pillbugs do not have a waxy outer coating (i.e. a cuticle) that covers their bodies, they are extremely vulnerable to “drying out.” Pillbugs in environments with lower than 50% humidity will die of dehydration within one day. (Note: 50% humidity means that the air is “filled” with only 50% of the water vapor that it CAN hold.) Once the humidity levels reach over 87%, pillbugs can absorb water through their body walls to rehydrate.

When outdoors, pillbugs typically choose to forage for food in cool, humid locations (ex: underneath a log). When inside a house, pillbugs can be found on water pipes or in cellars. Pillbugs, like insects and their relatives, must shed their hard outer skin or exoskeleton to grow. They do this a dozen or more times during their lives. Pillbugs generally hide when they shed their skin because they are especially vulnerable to enemies at this time. The average life span of most pillbugs is about 2 years, but some have lived as long as 5 years.

**Procedure:**

In this lab, you will be investigating the environmental preferences (wet or dry) of pillbugs (AKA roly-polies . You will create a “choice chamber” where one side of the petri dish contains wet filter paper and the other side contains dry filter paper. You will place 10 pillbugs in the passageway of the choice chamber at the start of the experiment and record the number of pillbugs on each side of the chamber every minute for 20 minutes.

For this experiment, we will be attempting to reject or fail to reject (support) the **null hypothesis**, which says “There is no statistically significant difference between the average number of worms on the wet and dry sides over the 20 minutes.”

If we reject the null hypothesis, we are supporting our **alternate hypothesis**. Please complete the alternate hypothesis below based on what you know about the normal habitat (wet or dry) of pillbugs.

‘If pillbugs are given a choice between a wet and dry environment, they will choose a \_\_\_\_\_\_\_\_ environment, resulting in an average number of worms on the \_\_\_\_\_\_\_\_ side that is significantly higher than the average number of worms on the \_\_\_\_\_\_\_ side over the 20 minutes.”

After collecting our data, we will use a statistical test called a Chi Square test to determine whether we should reject or fail to reject (support) our null hypothesis.

Following the initial choice chamber experiment, you will be provided with a number of different options to design and conduct your own experiment to test another variable in the choice chamber.

**Data:**

|  |  |  |
| --- | --- | --- |
|  | **# of Worms on Wet Side** | **# of Worms on Dry Side** |
| Mean (Average) over the 20 minutes for Group 1 | 6 | 4 |
| Group 2 | 5 | 5 |
| Group 3 | 7 | 3 |
| Group 4 | 4 | 6 |
| Group 5 | 5 | 5 |
| Group 6 | 8 | 2 |
| Group 7 | 6 | 4 |
| Group 8 | 7 | 3 |
| Group 9 | 5 | 5 |
| Group 10 | 3 | 7 |
| Sum of group averages for 10 groups | 56 | 44 |

**Analysis:** We are going to use a Chi square (X2) test to determine if our observed results match with our expected results (i.e. if our observed results match with what we would expect if the worms did not display a preference between wet and dry environments). We will need to use the sum of the group averages so that we have enough data for our Chi square test to give us meaningful information

***How do I perform a Chi square test?***

1. ***State the null hypothesis***

* In this case, our null hypothesis says that “There is no statistically significant difference between the average number of worms on the wet and dry sides over the 20 minutes.”

1. ***Determine your expected values***

* If we started with 100 worms (10 worms for each of the 10 groups in the class) and there is no difference between the number of worms on the wet and dry sides, we would expect there to be \_\_\_\_\_\_ worms on the wet side and \_\_\_\_\_\_ worms on the dry side.

***3. Calculate chi2***

* The formula is:
* Where o = observed value, e = expected value, and ∑ = the sum of
* So you would need to calculate separately for each value (ex: worms on wet side vs. worms on the dry side) and then add the results together
* Show your calculation for the chi square value below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Environment** | **Observed Value (Average)** | **Expected Value** | **Show your calculation** | **Chi square value (answer from the previous column)** |
| Wet |  |  |  |  |
| Dry |  |  |  |  |
| **Sum of your Chi square values** | | | |  |

***4. You will also need to know the degrees of freedom.***

* This is calculated using the formula (n-1)
* where n = the number of sets of results.(ex: the number of environments to choose from)
* How many degrees of freedom do we have for this experiment? \_\_\_\_\_\_\_

***5. Compare the X2 value against a table of critical values.***

* On the table to the right, refer to the row that corresponds to the correct number of degrees of freedom for your data set
* Look up the critical number at the p = 0.05 level. “p” stands for probability

**6. Make a conclusion**

* If the X2 value that you calculated in Step 3 is higher than the critical number at the p = 0.05 level then you can reject the null hypothesis. In other words, there is a statistically significant difference between the observed and expected results. (i.e. the observed results do not match the expected results)

*\*Note: A high X2 value corresponds with a low p value (below 0.05)*

* If the X2 value is less than the critical number then you fail to reject the null hypothesis. In other words, there is no statistically significant difference between the observed and expected results. (i.e. the observed results match the expected results)

*\*Note: A low X2 value corresponds with a high p value (above 0.05)*

**Discussion / Conclusion:** In your discussion / conclusion section, please include the following requirements. Write your discussion / conclusion on a separate piece of paper and staple to the back of this packet to turn in. Break your conclusion down into Parts 1, 2, and 3.

|  |  |
| --- | --- |
| **Requirement** | **Points Received** |
| 1) State whether your chi square analysis allows you to reject or fail to reject (support) your null hypothesis. | /1 |
| 2) Explain what it means to reject of fail to reject (support) your null hypothesis for this experiment. To do this, you must answer the following questions:  -Was there a statistically significant difference between your observed results and the expected results?  -Could you conclude that the worms display an environmental preference? If so, what environment do they prefer? | /1  /1 |
| 3) Explain how your calculated chi square value allows you to reject or fail to reject (support) your null hypothesis. To do this, you must include the following information:  -You must explain how you determined the critical number at a probability (p) value of 0.05 using a critical values table. You must identify the degrees of freedom and the critical number for this data.  -You must state whether your calculated chi square value is higher or lower than the critical number, whether your p value is higher or lower than 0.05, and connect this to rejecting or failing to reject (supporting) the null hypothesis. | /3  /3 |

**Total Points: \_\_\_\_\_**

*A low p value means there is only a small chance that differences between your observed and expected are due to chance alone. In other words, a p value below 0.05 means there is a statistically significant difference between your observed and expected results.*

*A high p value means that there is a greater chance that differences between your observed and expected values are due to chance alone. In other words, a p value above 0.05 means there is not a significant difference between your observed and expected results.*